CLAIMS:

1. In an optoelectronic timing system, an optical compensation system for advancing or retarding an optical pulse within a pre-defined pathway, the system comprising:

at least one semiconductor laser configured to issue subnanosecond optical pulses defining a periodic pulse train;

a first optical waveguide, the waveguide configured to define a first time-quantifiable optical path for a pulse of the train;

a second optical waveguide, the second waveguide configured to define a second time-quantifiable optical path for a pulse of the train different from the first waveguide and coupled to the first waveguide through an optical switch; and

wherein, the length of the second time-quantifiable optical path has a defined numerical relationship to the length of the first time-quantifiable optical path, such that a pulse traversing the second path has a travel time lengthened by a specific quantity with respect to the same pulse traversing the first path.

2. The system according to claim 1, further comprising:

a third optical waveguide, the third waveguide configured to define a third time-quantifiable optical path for a pulse of the train different from the first and second waveguide and coupled to the first waveguide through a second optical switch; and

wherein, the length of the third time-quantifiable optical path has a defined numerical relationship to the

length of the first and second time-quantifiable optical paths, such that a pulse traversing the first path defines a nominal travel time, a pulse traversing the second path having a travel time lengthened by a specific quantity with respect to the same pulse traversing the first path, and a pulse traversing the third path having a travel time shortened by a specific quantity with respect to the same pulse traversing the first path.

3. The system according to claim 2, wherein the particular one of the paths chosen for traversal is defined by operation of the first and second optical switches.

4. The system according to claim 3, further comprising:

a multiplicity of additional optical waveguides each coupled to the first and second nodal points, the additional waveguides configured to define a multiplicity of time-quantifiable optical paths; and

wherein, the lengths of each of the multiplicity of additional time-quantifiable optical paths having a numerical relationship with each other and with the first time-quantifiable optical path.

5. The system according to claim 4, the multiplicity of additional optical waveguides comprising a previous pulse path and a subsequent pulse path the previous and subsequent pulse paths operationally coupled to the first and second optical switches, the arrival times of a previous and a subsequent pulse defining operation of the optical switches such that the subsequent pulse is directed

through the first, second or third time-quantifiable optical path.

6. The system according to claim 5, wherein the semiconductor laser develops pulses at a rate defining a time spaced-apart fundamental frequency of the system.

7. The system according to claim 6, wherein the system is configured in a feed-back loop in which an actual arrival time of a subsequent pulse is compared to an expected arrival time of the pulse and the pulse travel time is either advanced, retarded or maintained at a nominal condition by being directed through the first, second or third time-quantifiable optical path, so as to maintain a pre-defined time spaced-apart periodicity relationship between each pulse.

8. The system according to claim 7, wherein time quantification of the optical path length is defined by the distance required for a pulse to travel at the speed of light for a given time interval.

9. In an optoelectronic timing system, an optical compensation method for advancing or retarding an optical pulse within a pre-defined pathway, the method comprising:

configuring at least one semiconductor laser to issue subnanosecond optical pulses defining a periodic pulse train;

configuring a first optical waveguide to define a first time-quantifiable optical path for a pulse of the train;

configuring a second optical waveguide to define a second time-quantifiable optical path for a pulse of the train different from the first waveguide

coupling the first waveguide to the second waveguide through an optical switch; and

wherein, the length of the second time-quantifiable optical path has a defined numerical relationship to the length of the first time-quantifiable optical path, such that a pulse traversing the second path has a travel time lengthened by a specific quantity with respect to the same pulse traversing the first path.

10. The method according to claim 9, further comprising:

configuring a third optical waveguide to define a third time-quantifiable optical path for a pulse of the train different from the first and second waveguide and coupled to the first waveguide through a second optical switch; and

wherein, the length of the third time-quantifiable optical path has a defined numerical relationship to the length of the first and second time-quantifiable optical paths, such that a pulse traversing the first path defines a nominal travel time, a pulse traversing the second path having a travel time lengthened by a specific quantity with respect to the same pulse traversing the first path, and a pulse traversing the third path having a travel time shortened by a specific quantity with respect to the same pulse traversing the first path.

11. The method according to claim 10, wherein the particular one of the paths chosen for traversal is defined by operation of the first and second optical switches.

12. The method according to claim 11, further comprising:

coupling a multiplicity of additional optical waveguides to the first and second nodal points;

configuring the additional waveguides to define a multiplicity of time-quantifiable optical paths; and

wherein, the lengths of each of the multiplicity of additional time-quantifiable optical paths having a numerical relationship with each other and with the first time-quantifiable optical path.

13. The method according to claim 12, the multiplicity of additional optical waveguides comprising a previous pulse path and a subsequent pulse path the previous and subsequent pulse paths operationally coupled to the first and second optical switches, the arrival times of a previous and a subsequent pulse defining operation of the optical switches such that the subsequent pulse is directed through the first, second or third time-quantifiable optical path.

14. The method according to claim 13, wherein the semiconductor laser develops pulses at a rate defining a time spaced-apart fundamental frequency of the system.

15. The system according to claim 14, wherein the system is configured in a feed-back loop in which an actual arrival time of a subsequent pulse is compared to an

expected arrival time of the pulse and the pulse travel time is either advanced, retarded or maintained at a nominal condition by being directed through the first, second or third time-quantifiable optical path, so as to maintain a pre-defined time spaced-apart periodicity relationship between each pulse.

16. The system according to claim 15, wherein time quantification of the optical path length is defined by the distance required for a pulse to travel at the speed of light for a given time interval.

17. An optoelectronic timing system comprising:

at least one semiconductor laser configured to output optical pulses at a rate defining a particular frequency;

a first optical waveguide having a first fundamental length, the waveguide subdivided into physical length segments, each segment having a length equal to the other segments, each length segment and the fundamental length defining a time-quantifiable optical path for a pulse of the train based upon the time required for a pulse to travel a particular length segment at the speed of light;

a pulse detector coupled at a terminal portion of each length segment so as to issue a signal upon detection of a pulse traversing the length segment; and

wherein, the periodicity of pulses received at the pulse detector is a multiple of the particular laser output frequency, the multiple based solely on the fundamental length and the number of length segments of the first waveguide.

19. The system according to claim 17, further comprising:

a multiplicity of additional optical waveguides, each having a respective fundamental length, each waveguide further subdivided into physical length segments, each segment having a length equal to the other segments, each length segment and respective fundamental length defining a time-quantifiable optical path for a pulse of the train based upon the time required for a pulse to travel a particular length segment at the speed of light;

a pulse detector coupled at a terminal portion of each length segment of each of the multiplicity of additional optical waveguides so as to output a signal upon detection of a pulse traversing the length segment; and

wherein, the multiplicity of additional optical waveguides are disposed in a sequential fashion, such that a pulse detector of one of the multiplicity operationally controls development of a pulse in a next sequential waveguide of the multiplicity.

19. The system according to claim 18, further comprising

a semiconductor laser disposed to receive an output from a pulse detector of one waveguide of the multiplicity and develop an optical pulse into a next sequential waveguide of the multiplicity; and

wherein each waveguide of the sequence has a fundamental length proportional to a length segment of the prior waveguide in the sequence.

20. The system according to claim 19, wherein an optical pulse travel time along the fundamental length of

one waveguide of the sequence differs from an optical pulse travel time along the fundamental length of an adjacent waveguide in the sequence by one order of magnitude.